Patent
Attorney's Docket No. 1015290-000794

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	**Mail Stop Amendment**
	)	
Daxing Ren	)	Group Art Unit: 1765
	)	
Application No.: 10/706,938	)	Examiner: Duy-Vu N. Deo
	)	
Filed: November 14, 2003	)	Confirmation No.: 7427
	)	
For: SILICON CARBIDE COMPONENTS OF SEMICONDUCTOR SUBSTRATE PROCESSING APPARATUSES TREATED TO REMOVE FREE CARBON	)	

DECLARATION BY DAXING REN UNDER 37 C.F.R. § 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Daxing Ren, hereby state as follows:

1. I invented the subject matter claimed in the present application.

2. I have worked at Lam Research Corporation ("Lam") since October, 2000. From October, 2000 to February, 2004, I worked as a Senior Product Engineer. Since February, 2004, I have worked as a Staff Product Engineer. I earned a Bachelor of Science degree in physical chemistry from Zhongshan University, Guangzhou, China, in 1982; a Master of Science degree in inorganic synthesis chemistry in 1985 from Zhongshan University; and a Ph.D. in analytical chemistry in 1997 from The Surface Center & Department of Chemistry, University of Cincinnati, Cincinnati, OH. I also had Postdoctoral position from 1998-2000 at the Department of Chemical Engineering, Carnegie Mellon University, Pittsburgh, PA. At Lam, I have worked in areas including reducing defects in dielectric etch systems; bonding of electrodes for particle performance improvement; electrode cleaning and

refurbishing procedures; improving silicon carbide baffle performance; and reducing metal levels in electrodes.

3. The claimed subject matter in the present application is directed to a silicon carbide component made by a carbon conversion process that results in the component including free-graphite in the component's interior. The silicon carbide material made by the carbon conversion process is referred to hereinafter as "converted SiC." The converted SiC material is porous.

4. I have reviewed U.S. Patent No. 6,464,843 to Wicker et al. ("Wicker"). Wicker discloses silicon carbide members. Wicker mentions "oxygen cleaning steps" at column 7, lines 15-17 and 22; and an ashing process wherein oxygen can be run for 10 seconds at column 7, lines 17-19.

5. Plasma etch chambers are conventionally "conditioned" prior to processing production wafers in the chambers. Chamber conditioning is a simulated production process that uses production process conditions, but with dummy wafers instead of production wafers. Chamber conditioning is performed prior to processing production wafers in the plasma etch chamber.

6. As described at paragraphs **[0039]** to **[0041]** of the present application, a plasma processing chamber (dielectric etch chamber) was conditioned in two tests with a different converted SiC baffle plate being contained in the chamber during the respective conditioning processes. In test A, the chamber was conditioned with a silicon carbide baffle plate (baffle plate A) composed of converted SiC that was not previously treated to remove free-carbon (Curve A) installed in the chamber. In test B, the same conditioning process was run in the chamber, but with a silicon carbide baffle plate (baffle plate B) composed of converted SiC that was previously treated in an oven flowing O_2 at high temperature to remove free-carbon (Curve B) installed in the chamber. Baffle plates A and B were new parts, i.e., they had not previously

been installed in a plasma processing chamber. The chamber hardware was the same for tests A and B except for the different silicon carbide baffle plates A and B.

7. The conditioning process used in tests A and B included a wafer-less autocleaning ("WAC") step, which was performed in the chamber after processing every 25 wafers and a resist ashing step, which was performed after processing every wafer. The total process time for each dummy wafer was about 4 minutes of RF time. In the WAC step, O_2 was used to generate an oxygen plasma to clean the chamber. The WAC step typically had a duration of about 60 seconds of RF time. In the resist ashing step, a resist layer was stripped from a dummy wafer using O_2 to generate an oxygen plasma in the dielectric etch chamber. The resist ashing step typically had a duration of about 45 seconds of RF time.

8. FIG. 1 shows the relationship between the number of particle adders deposited on 200 mm dummy wafers versus the duration (RF hours) of the chamber conditioning for tests A and B. The RF hours is the number of hours that a plasma was generated in the chamber during conditioning. Particle counts were obtained at specific intervals in each test (e.g., after a certain number of RF hours). For example, "2 RF hours" means that particle count data was obtained after the test was run for 2 RF hours for a respective baffle plate.

9. Curve B in FIG. 1 of the present application shows that the number of particle adders having a size of at least about 0.2 μm deposited on dummy wafers in the chamber containing treated baffle plate B was less than about 10 after only about 2 RF hours of chamber conditioning (which is equivalent to processing about 30 wafers), and the number of particle adders was further decreased to about 5 by extending the duration of the chamber conditioning.

10. In contrast, Curve A in FIG. 1 shows that the number of particle adders deposited on dummy wafers in the chamber that contained un-treated baffle plate A

was significantly higher than 20, even after more than 45 RF hours of testing (which is equivalent to processing about 675 wafers).

11. The test results show that removing free-carbon from the silicon carbide baffle plate by treating in an oxygen-containing atmosphere outside a plasma processing chamber significantly reduces the generation of adder particles in the chamber during wafer processing operations compared to a baffle plate that was not subjected to such pre-treatment.

12. As the test results shown by curves A and B differed only in that baffle plate B was a part treated to remove free-graphite in the interior of the baffle plate, because baffle plate A continued to generate a large number of particles even after over 45 RF hours of chamber conditioning, it appears that a significant amount of free-graphite remained in baffle plate A and caused the higher particle generation shown in curve A. As Wicker discloses a conventional conditioning process, it is my opinion that Wicker's conditioning process would not be effective to remove free-graphite from the interior of a converted SiC component.

13. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: March 23, 2007

Daxing Ren